

**Project Goal:** <Insert goal(s) here>

### **Analysis 1**

1. Attach your balloon design diagram. On the diagram include a list of your materials used and the dimensions of all the assembled components.

2. Identify all the measurable variables for the design of the hot air balloon, e.g. surface area, albedo, etc. For each variable state the following:

A. Variable used to describe the measurement algebraically, e.g. volume is typically denoted by the variable 'V'.

B. The unit of measurement for each measurement, e.g. surface is typically measured in square meters.

C. What calculated values are based on these measured values, e.g. the surface area is used to calculate the absorbed power from sunlight.

3. Identify all of the measurable variables for the environment of the hot air balloon which will impact its flight ability, e.g. air temperature, sunlight intensity, etc.

A. Variable used to describe the measurement algebraically, e.g. volume is typically denoted by the variable 'V'.

B. The unit of measurement for each measurement, e.g. surface is typically measured in square meters.

C. What calculated values are based on these measured values, e.g. the surface area is used to calculate the absorbed power from sunlight.

4. Show the formulas used to determine the following:

A. Mass of air in balloon as a function of temperature.

B. Total mass of balloon as a function of temperature.

C. Total density of balloon as a function of temperature.

D. Absorbed power from sunlight as a function of sunlight intensity and surface area.

E. Absorbed energy from sunlight as a function of absorbed power and time.

F. Number of moles of air in the balloon, assuming all of the air is oxygen, as a function of mass of air in the balloon.

G. Predicted change in temperature as a function of absorbed energy and the number of moles of air in the balloon.

H. Predicted change in air density as function of temperature.

I. Overall density of balloon as a function of temperature.

5. Choose a single design variable and state, with justification, how this variable will help the balloon achieve liftoff. This is the hypothesis.

### **Analysis 2**

1. Did the balloon achieve flight? What variable is the primary cause of the balloon achieving flight or not achieving flight? This variable could be an environmental or design variable.

2. Change the variable identified in question 1 of Analysis 2 and rerun the balloon experiment.

3. For the second balloon trial, independent of the balloon achieving flight, identify two new environmental and two new design variables which could have contributed to the balloon's observed behavior. Explain how these variables would contribute to the balloon's observed behavior.